

10/674,967

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AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph at page 6, line 28 - page 7, line 6 with the following amended paragraph:

Since a number of fringes increases linearly with optical path length, sensitivity of the optical sensing system is also increased as a function of length of the photo-elastic material. In the prior art, by restricting the light direction to be only radial, the path length of the beam was limited to two times the thickness of the photo-elastic collar. However, it is desirable to keep the collar relatively thin to avoid problems with collar mounting, minimize vibration, minimize forces during rotation, and avoid optical distortion from thick materials. Additionally, it is to be understood that a reflective substance on a collar of the photo-elastic sleeve is not required to practice the invention, as strain on the shaft can be determined when a beam of light passes through an end photo-elastic sleeve and data collected at such end as compared to the light reflecting backward from such end.

Please replace the paragraph at page 15, line 27 - page 16, line 13 with the following amended paragraph:

An early breakage detector 560 can be employed in connection with the capturing component 540 to detect defects in the member 510. The early breakage detector ~~550~~ 560 analyzes the light received by the capturing component 540. Software algorithms can be utilized to monitor rotating members 510 for fatigue, cracking, early signs of breakage, *etc.* The software algorithms can employ various techniques to provide such results. For example, a birefringence pattern can be analyzed to determine whether the pattern is axisymmetric. A birefringence pattern which is not axisymmetrical can indicate an early sign of failure of the shaft. A section of member 510 exhibiting an initial crack can show a stress concentration in the vicinity of the crack when analyzed by Early Breakage Detector 560. Alternatively, the software algorithm can be employed to examine the frequency response. An early sign of shaft failure is demonstrated by a frequency shift and/or frequency smearing resulting from a load change.

10/674,967

02AB125C

Another indication of fatigue is exhibited by an impulse in the joint time-frequency response. Techniques such as joint time frequency analysis (e.g., wavelet analysis) are particularly well-suited to detect momentary fluctuations or impulses indicative of crack growth or defect initiation. Utilization of optical, neural-net torque sensors enables implementation of such software algorithms targeted at impulse, frequency response and joint time frequency-response for detecting early stages of shaft failure. Early detection of fatigue, cracks, *etc.* within the shaft prevents catastrophic events such as, for example, radial shaft cracks, sheared shaft material, axial shaft splits, *etc.*

Please replace the paragraph at page 29, lines 14-23 with the following amended paragraph:

When linearly polarized light passes through a strained photoelastic material and is viewed through a polarizer, colorful fringe patterns are observed. These two-dimensional optical fringe patterns can be used for stress analysis. According to Brewster's Law, the relative change in index of refraction (n) is proportional to the difference in principal strains (ϵ) as shown in Equation 1. The constant of proportionality, K , is called the "strain-optic" coefficient. The amount of phase shift (e.g., relative retardation δ) is a function of wavelength of light, material thickness, t , strain-optic coefficient, K , and the difference in principal strains, $(\epsilon_1 - \epsilon_2)$, as shown in Equation 1. The photoelastic effect is typically used in transmission as shown in Fig. 14B or in reflection. The relative phase retardation of the beam exiting the photoelastic material is given by δ in Equation 1.

Please replace the paragraph at page 30, lines 11-27 with the following amended paragraph:

In accordance with the subject invention, the photoelastic material covers a portion of the shaft material (e.g., in the form of a collar or sleeve). Light enters the material from a radial direction and is reflected off the inside surface thereof, and reflected back through the material in a radial direction where it is sensed with an optical device such as for example a photodiode

10/674,967

02AB125C

array. Since the photoelastic material can be used in reflection (rather than just transmission), the light beam passes through the optical material twice. The equation to be used to compute the number of fringes for the torsional load sensor is given by (4).

$$N = 2tK(\epsilon_1 - \epsilon_2) / \lambda \quad (4)$$

The resulting two-dimensional fringe pattern is quantifiable and reproducible. Therefore, this problem can be viewed as a general, 2-dimensional pattern classification problem. A classifier (e.g., neural network) is well suited to this problem and has been shown to be a fast, efficient, and accurate solution method for this application. A photoelastic sensor in accordance with one specific embodiment of the subject invention can be characterized as a dynamic load sensor due to the broad ~~and~~ range of sensing capabilities and the availability of high frequency torsional load information in addition to speed and low frequency torsional load values (e.g., torque).